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Toxicity of Peroxyacetyl Nitrate on Human

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Abstract

In recent years, air pollution has been a major threat due to photochemical smog in china, which continuously increases the concentration of photochemical pollutants. Pan is formed by the reaction of nitrogen oxides and hydrocarbon under action of light. Nitrogen dioxides comes from engines of trucks and cars and from power plants that burn coal. It enables passage and release of NOx to the remote troposphere which cause distribution of ozone and OH, main tropospheric oxidants. Pan is secondary pollutants. The toxicity of ozone is more than acute toxicity of pan but pan toxicity is similar to NO2 and higher than SO2.Damage to epithelium of respiratory tract and severe lung problems were seen in animals. The pan concentration is well above the maximum ambient concentration. Present ambient concentration would affect pulmonary functions. Lowest level causing eye irritation in human. This review will be helpful to understand the PAN toxicity and also would be capable to minimize the PAN toxicity.

Keywords: Toxicity; Peroxyacetyl; Nitrogen dioxides

Introduction

Toxicity is the degree to which a toxin or poison can harm human or animal. Acute toxicity includes toxic effects in an organism along a single or short-term exposure. In Sub chronic toxicity toxic substance can cause effects for more than one year but lesser than lifetime of organism. Chronic toxicity can cause effects over an extended period sometimes lasting for whole life of an organism [1].

To identify some of the products Franklin Institute Laborites use first long-path infrared gas cell and enables searching the infrared spectrum of olefin-NOx photolyzed mixtures when bi acetyl was studied a set of infrared bands observed in chemical reactions with 3-methylpentane was very strong [2]. The strong bands at 1740 cm-1 and 1841 cm-1 were relatively unique and molecule was labeled “compound X” by research team. From bi acetyl reaction team try to isolate compound X but two drop sample traps exploded violently before able to make a spectrum. The five structures proved to be in correct. The correct structure, CH3CO-00-NO2 was not determined [3]. In 1961, produce the correct structure for compound X (peroxyacetyl nitrate) [4]. This structure was accepted as correct finally by infrared studied of labeled PAN further studied identified that PAN is a key compound which cause tanning of leaves further studied that PAN is 10-50 times more toxic than ozone to plants [5,6].

PAN (peroxyacetyl nitrate) is a type of air pollution. Pan is a part of smog. It can damage our eyes and our lung. It also damages plants. Some chemicals combine in air to form pan. One of them is nitrogen dioxide (NO2). It comes from engines of trucks and cars and from power plants that burns coal and factories. Volatile organic compounds (VOCs) also help to make pan. VOCs come into the air from paints, gasoline and other chemicals. Sunlight changes the VOCs into other chemicals. Then chemical combines oxygen and nitrogen dioxide to make pan [7]. Pan is secondary pollutants they form after emission of primary pollutants from the atmosphere. Source of these pollutants are motor vehicles, burning of fossil fuels and tobacco smog [8].

They are directly emitted from a source into the environment. They differ from secondary pollutants. They can be emitted from many sources like car, power plants, biomass burning, natural forest fire etc. Types of primary pollutants are; Nitrogen oxides (NOX), Carbon Monoxide (CO), Sulfur oxides (SO), Mercury [9].

PAN is formed by action of sunlight on organic they form in the atmosphere. They are not emitted directly from the source in the environment. They form when pollutants from a source react with air in the atmosphere. Types of secondary pollutants are; Ozone (O3), Sulfuric acid and nitric acid, Nitrogen dioxide (NO2), Peroxyacetyl nitrate [10].

Mechanisms of Peroxyacetyl Nitrate

PANs and its homologous are formed in polluted air. It is formed by reaction of acylate radicals and nitrogen trioxide. The reaction accounts for late formation of peroxyacetyl nitrate upon radiation of nitrogen and hydrocarbon at low concentration in air. It also describes why peroxyacetyl nitrate is not formed at high concentration. It also explains the formation of peroxyacetyl nitrate in dark reaction of oxygen, N2O5, acetaldehyde. Finally, it explains the inhibiting effect that excess NO2 has on dark reaction. The reaction could yield peroxyacetyl nitrate molecular structure or acetyl pernitrate structure which does not include oxygen-oxygen bond. Molecule’s chemical properties can be reconciled with either formulate [11]. In air pollution why, pan formation occurs late in atmospheric chemical changes? It has been noticed repeatedly that pan does

not shown in photolysis of polluted air until NO reduced to very low concentration. NO2 reached at high level and ozone build up in concentration [12].

Synthesis of PAN

Methods for synthesis and isolation of PAN was first developed by Edgar Stephens and colleagues at UCR [13]. To produce PAN Ethyl nitrate was photolyzed in air. The PAN was placed in large air canisters, diluted in zero air, and stored in a cool room for chemistry study and many other purposes. Number of publications on PAN's toxicity and its chemical and physical properties resulted from use of photoreactor system [14]. Explosions described with use of photoreactor system usually were connected with the condensation of volatile peroxyacetyl nitrates (PANs) in a vacuum or pressure gauge system. Other photochemical the production methods employed followed the general photochemical reaction system using halogen. To separate the PAN for instrument setting or laboratory study these methods require chromatography and photochemical apparatus. PAN can consider a mixed anhydride of peracetic acid and nitric acid [15]. Gaffney and his team modified the technique to overcome possible safety hazards of working with PAN dissolved in a high-volatility solvent and suggested that n-tridacna be used for high purity PAN and derivative synthesis. Advances in the synthesis of PANs have led to enhancements in analytical procedures and in determinations of the chemical and Physical properties of Pans. To confirm the PAN structure observed products of base hydrolysis. Simple ultraviolet absorption spectrum of PAN observed by Stephens was confirmed by Senum, Lee, and Gaffney at Brookhaven National Laboratory in the early 1980s. In the meantime, PAN was observed by Stephens and others to decompose thermally to form methyl nitrate, carbon dioxide, and other minor products. Han want Singh was the first to point out that PAN could act as a means of transporting NOZ over very long distances and therefore was a globally important molecule and not just an urban air pollutant.

Importance of PANs as phytotoxic air pollution

Peroxyacetyl nitrates are family of compounds. It forms by photochemical reactions between contaminants which released to the atmosphere by combustion of organic fuels. In some polluted areas peroxyacetyl nitrate is responsible for major plant injury and most abundant member of this family. At least 19 states plants injury has been recognized. Pan stop the activity of enzyme by attacking sulfhydryl group and yield visible symptoms in plants when exposed for 4 hours to about 14 ppb. Other chemicals are more toxic than pan in family.

Effects

Pans have many effects on human body like respiratory function, eye irritation, emphysema, and other lung problems. Human exposure to PANs mostly occurs in urban areas because automobile and industrial emissions are high. In colder areas temperature around -20C pans have lifetime of about 3 months but in warmer areas it is only a few hours. PANs can be transported large distances. PANs can contribute to air pollution in places far away from their source. A variety of chemicals like carbon monoxide and carbon dioxide can be produced under decomposition of pans.

Conclusion

This study concluded that peroxyacetyl nitrate toxicity is very dangerous to human. PAN cannot be controlled but its exposure can be minimized. We should minimize nitrogen oxides and hydrocarbon which are main source of PAN. We should check engines of trucks and other vehicles which cause pollution. Factories should be established away from the human population due the toxic effect of PAN and other pollutants. Power plants that burns coal should be controlled in a better way to avoid PAN toxicity. We should maintain our fireplace and wood stove. We should minimize burning of fossil fuels. To minimized exposure of PAN, alarms and detector should be used.

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